BRITISH STANDARD

BS EN
1395-6:2007

Thermal spraying — Acceptance inspection of thermal spraying equipment —

Part 6: Manipulator systems

The European Standard EN 1395-6:2007 has the status of a British Standard

ICS 25.220.20

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 1395-6:2007. This standard together with BS EN 1395-1, BS EN 1395-2, BS EN 1395-3, BS EN 1395-4, BS EN 1395-5 and BS EN 1395-7 supersedes BS EN 1395:1996.

The UK participation in its preparation was entrusted to Technical Committee STI/40, Thermally sprayed inorganic finishes.

A list of organizations represented on STI/40 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Thermal spraying - Acceptance inspection of thermal spraying equipment - Part 6: Manipulator systems

Projection thermique - Contrôle d'acceptation du matériel de projection thermique - Partie 6: Système de manipulation

Thermisches Spritzen - Abnahmeprüfungen für Anlagen zum thermischen Spritzen - Teil 6: Handhabungssysteme

This European Standard was approved by CEN on 23 December 2006.

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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Page

Foreword

This document (EN 1395-6:2007) has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2007, and conflicting national standards shall be withdrawn at the latest by July 2007.

This document together with EN 1395-1, 1395-2, 1395-3, 1395-4 1395-5 and 1395-7 supersedes EN 1395:1996.

EN 1395 consists of the following Parts, under the general title *Thermal spraying — Acceptance inspection of thermal spraying equipment*:

— *Part 1: General requirements;*

— *Part 2: Flame spraying including HVOF;*

— *Part 3: Arc spraying;*

— *Part 4: Plasma spraying;*

— *Part 5: Plasma spraying in chambers;*

— *Part 6: Manipulator systems;*

— *Part 7: Powder feed systems.*

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1 Scope

This European Standard specifies requirements for the acceptance inspection of thermal spraying equipment in this case manipulator systems used in spray jobs to produce thermally sprayed coatings of reproducible quality.

This part should be used in conjunction with EN 1395-1, which includes general requirements and explanations of procedures.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 657:2005, *Thermal spraying — Terminology, classification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 657:2005 and the following apply.

3.1
manipulators
equipment for horizontal and/or vertical repositioning and/or rotating of objects

4 Acceptance inspection

4.1 Purpose of acceptance inspection

5.1 to 5.4 reveal state of the art technology in thermal spraying equipment and the minimum requirements concerning accuracy of motion of a spraying gun and/or work piece as given in Annex A, Table A.2.

4.2 Preliminary conditions for inspection

The manipulator system shall be installed according to the instructions of the manufacturer/supplier. It shall be completely fitted with any other manipulator equipment necessary for the spraying process, aligned, adjusted and shall be able to operate. Measurements see Annex A, Table A.1.

5 Manipulators for thermal spraying

5.1 General

Generally, manipulators used for thermal spraying may move the gun and/or the work piece to be sprayed.

Usually, manipulators used for thermal spraying do not need the same positioning accuracy as systems for positioning of tools when e.g. chip cutting on milling or drilling machines, due to a spreading of the spray spot as well as to masking of the area not to be sprayed. These circumstances allow larger tolerances in positioning the spray gun and/or the work piece.

5.2 X-Y-Z gun manipulators

X-Y-Z gun manipulators are often used instead of industrial robots. These manipulators provide less accuracy, repeatability and travel speed compared with industrial robots. Nevertheless, gun manipulators are adequate for many typical spray jobs. Tolerances depend on application, spray process and work piece and should be agreed upon between the contracting parties.

Typical values are given in Annex A.

5.3 Industrial robots

Usually, industrial robots possess 5 axes or 6 axes. All movements of the axes may be programmed by free hand or PC control. Standard machine robots may be used together with an additional positioner, such as a turntable or tiltable turntable. Usually, movement of the robot and/or work piece to be sprayed and the spraying process are connected via a program where either the manipulator or the spraying process may guide the complete process. The motion speed of the gun or work piece and accuracy of positioning shall fulfil all requirements for the particular thermal spraying processes agreed.

Inspection tests may be carried out according to EN ISO 9283 with an adequate scope of testing related to the requirements of accuracy for thermal spraying processes.

5.4 Manipulators for rotating of components (rods and rolls)

This subclause concerns the acceptance test for manipulators for rotating of components for thermal spraying showing standard accuracy. Preparatory procedures and geometric tests of the manipulator equipment regarding the accuracy of manufacture and installation are described in the Annex A, Table A.1 and Table A.2.

The contracting parties shall agree if not all tests can be carried out or additional tests are necessary. National laws and regulations issued for health and safety shall be followed. The test methods only require the test gauges used for geometrical measurements which are commonly available in most job shops.

Smaller tolerances should be agreed between the contracting parties.

6 Designation

Acceptance inspection of manipulators for thermal spraying shall be designated as follows:

Acceptance inspection according to EN 1395-6.

7 Inspection report

An example for the inspection report is given in Annex A.

Annex A
(informative)

Inspection report for thermal spraying manipulator system (initial test/retest)

The initial test/retest fulfils the requirements of the acceptance inspection according to EN 1395-6.

User:.....

Manufacturer:.....

Year of manufacture: .....

Type of manipulator system:.....

Type of manipulator device:.....

Type of equipment: .....

: .....

.....

Type of programming system: .....

CE-documentation complete: yes / no

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Table A.1 — Preparing measurements

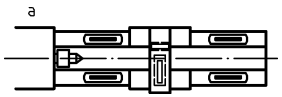
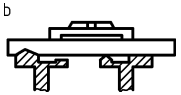
No.	Test item	Figure	Test apparatus	Testing instructions	Tolerance	
					permissible	measured
P1	verification of levelling	 a in longitudinal direction	– precision level – optical or other methods – accessories (parallels, measuring bridge etc.) suited to the type of slide way	– carriage of middle of bed – make the measurements at a number of – positions equally spaced along the entire – length of the bed – place the level on the front or rear slide ways	1,0 mm L up to 500 mm (convex)	
P2		 b in transverse direction		– for both measurements the level may also be placed on the transverse slide or carriage – place level on measuring bridge (straightedge)	5 mm/m change in inclination	

Table A.2 — Geometrical testing

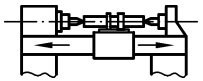
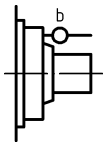
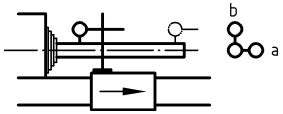
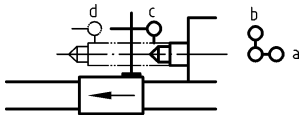
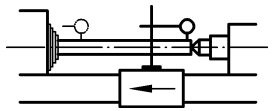
No.	Test item	Figure	Test apparatus	Testing instructions	Tolerance	
					permissible	measured
G1	straightness of carriage movement in the horizontal plane or in the plane defined by the axis of the centres and the tool point	a 	– L up to 1 500 mm dial indicator – test mandrel or straightedge 300 mm to 500 mm long	Mount test mandrel between centres. Dial indicator on carriage. Stylus bearing in the horizontal plane against the test mandrel. Traverse carriage along the test mandrel.	5 mm L up to 1 000 mm	
G2	accuracy of plane running of vertical plane		– dial indicator	Dial indicator on front face of spindle. Spindle to be turned slowly.	0,3 mm (including periodical axial slip)	
G3	parallelism of spindle axis with carriage movement over a length equal to half the maximum working diameter		– dial indicator – test mandrel with mounting taper	Test mandrel to internal taper or in chuck. Bring dial indicator to mid-way position of run-out. Bring stylus into contact with circumference of test mandrel. Traverse carriage through the test distance.	1 mm onto 300 mm in horizontal and vertical plane	

Table A.2 (*concluded*)

No.	Test item	Figure	Test apparatus	Testing instructions	Tolerance	
					permissible	measured
G4	parallelism of tailstock sleeve axis with carriage movement a in the horizontal plane b in the vertical plane		– dial indicator	Bring dial indicator into contact with retracted and locked tailstock sleeve at c. Advance sleeve through 100 mm and re-lock. Traverse carriage to d. Measure at position c, then at d.	a 1 mm to 100 mm b 1 mm to 100 mm	
G5	headstock and Tailstock centres for same height above reference plane		– dial indicator – test mandrel for mounting between centres	Tailstock and Tailstock sleeve locked. Bring dial indicator into contact with top surface line of the test mandrel. Measure at both ends of mandrel.	5 mm (Tailstock centre higher)	

Measured values of Tables A.1 and A.2 are essential part of this acceptance inspection: yes / no

Comments:.....

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.....

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.....

The manipulator system should be accepted for use with an equipment for the required thermal spraying process:

yes / no

Date:..... Inspector's signature: .....

Date:..... Customer's signature: .....

Date:..... Supplier's signature: .....

Bibliography

[1] EN 1395-1, *Thermal spraying — Acceptance inspection of thermal spraying equipment — Part 1: General requirements*

[2] EN ISO 9283, *Manipulating industrial robots — Performance criteria and related test methods (ISO 9283:1998)*

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